Available online at www.sciencedirect.com

SciVerse ScienceDirect

Procedia Engineering 26 (2011) 2428 – 2433

Procedia Engineering

www.elsevier.com/locate/procedia

First International Symposium on Mine Safety Science and Engineering

Partition and reclamation of rural settlements in mining areas: A case study of Cishan Town,Wu'an in China

Zhao Ji[a], Meichen Fu[a], Jianjun Zhang[a,] a*

[a]*School of Land Science and Technology,China university of Geosciences(Beijing),29,Xueyuan Road,Haidian District,Beijing 100083,China*

Abstract

This article relies on the construction of new countryside background, with a view to exploring the new ways to promote ecological safety and social security in mining areas, takes into full account of regional mineral resources, rural settlements location, land resources, human environment conditions to partition the rural settlement within the domain of the town. In the case study of Cishan Town, Wu'an city, multi-index evaluation method and zones superposition method are used. And then differentiated reclamation measures for different regions were proposed. Scientific planning of mining residential area, not only benefits the mining areas' resources security, but also promotes regional ecological security, social security building and protects the mining areas' socio-economic sustainable development.

Selection and/or peer-review under responsibility of China Academy of Safety Science and Technology, China University of Mining and Technology(Beijing), McGill University and University of Wollongong.

Keywords: Mining areas; security; rural settlement; partition; reclamation

1. Introduction

Since the reform and opening up, after several decades of development, all walks of life have undergone tremendous changes while mining has also been developing rapidly. But the triumph, while mining, mine safety issues are also being increasingly prominent area. Speaking from the production process, mine safety, includes risk management; appropriate attitudes and behaviors; reporting systems; education and training; and a focus on processes and equipment [1-2]. From a macro point of view, mine safety includes production safety, resource security, ecological security, social security and so on. They put forward higher requirement for sustainable development of mining, and the security environment becomes the prerequisite for safe production in mines [3].And in mining areas, economic development level is often higher than other regions. The expansionary demand for construction land is obvious, and in the security context of national food security needs to protect the cultivated land vigorously, thus forming a highlight contradiction in the process of optimal allocation of land and resources. So the mining area or mining city's development is becoming the focus of much attention [4]. With the high attention of new countryside construction [5-7], researching on mining areas' rural settlement partition and reclamation can strengthen the regional ecological environment effectively, allocate the land resource rationally, and improve the living condition of social live, and then

1877-7058 © 2011 Published by Elsevier Ltd. Open access under CC BY-NC-ND license.
doi:10.1016/j.proeng.2011.11.2455

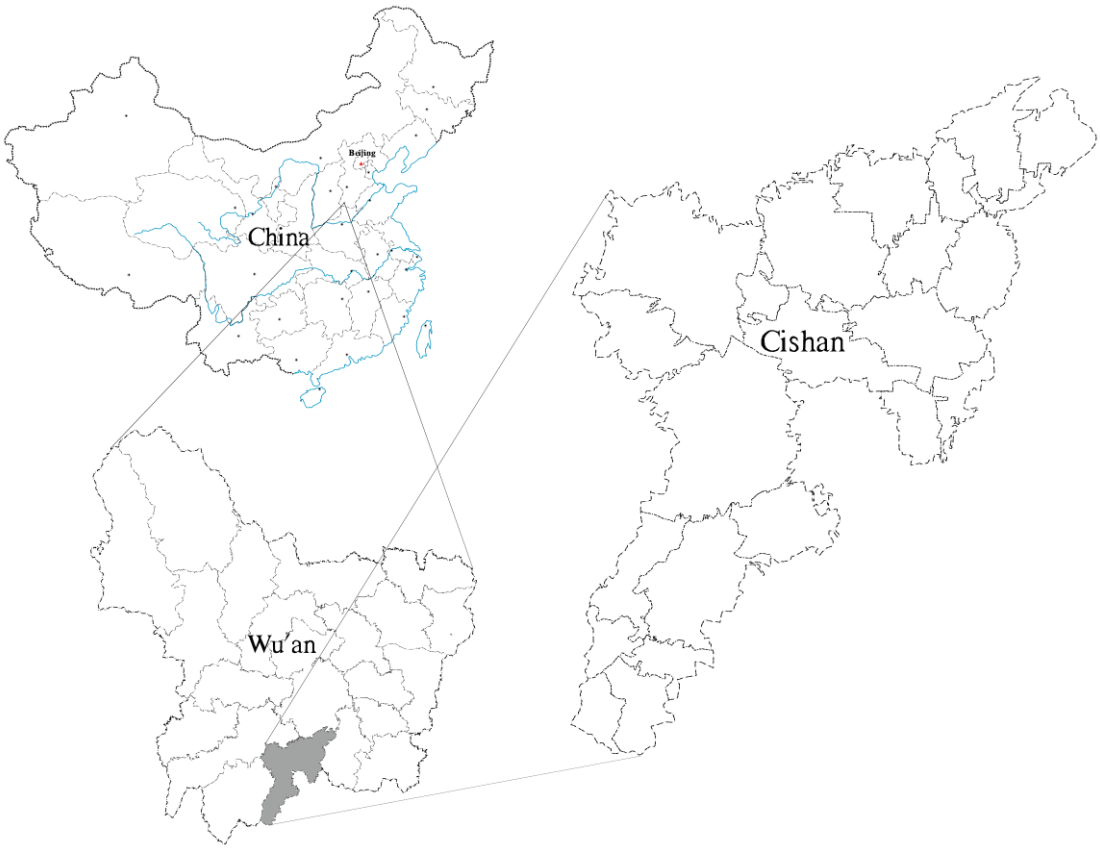

Fig.1. Study area, Cishan town

provide a good safety environment for the mine production security. Also in the present, China's rural development and urban development are in a transition stage [8]. The demand for the change from traditional agricultural society to modern industrialized and urbanized society is strong [9]. The transformation of mining cities needs to rely on mining features, from the resource, ecological and social of the corresponding view to explore new ways to maintain regional stability and security.

2. Study area

Cishan Town, a mining town belongs to Wu'an in Hebei province of China (Fig.1). It lies in the hilly transition zone in the south mountains of Wu'an city, and which accounted for 67% of hills, mountains to 14%, 19% plains, the terrain appears as the south than the in the north [10]. Cishan town has 23 villages and its region difference is very outstanding. Enterprises and villages in the east are more intensive and their economic conditions are better than the west. Eastern and central parts have roads and railways, so its transportation is well developed. It also has many industrial and mining enterprises as the terrain is flat. But the southwest parts are composed of high mountains and ravine, which led to the town size, pattern, and construction level of a large difference. Township is located in the southeast of the town. It has good location and development conditions which can act the role of political, economic and cultural centers.

3. Materials and methods

3.1. Data source and processing

The vector data of land use and related materials are obtained through the project of general plans for land use of Wu'an city. After getting the relevant indicators' base data, a unified treatment should be taken to form the vector map in the same pieces of form. In addition, parts of indicator data are collected from the local governments. They will be used to analyze the partition of rural settlement.

3.2. Methods

In the partition process of rural settlements in mining areas, two methods are used. They are type area superposition and comprehensive evaluation of multiple factors. The indicators' selection considered the regional characteristics of mine, the requirement for the indicators' quantizing and vectoring. And then, quantization model is established for partition of rural settlements. After that, comparison between the two methods result is made, and combined with the current status of the region to revise the results so that the final partition achievement can be worked out. For the type area superposition method, first, take a unified treatment for the partition indicator maps, and then use the software which called Mapgis for its space overlay function to achieve the initial partition. Comprehensive evaluation of multiple factors method has three parts. First, using Delphi method to determine the factor's weight, and then determining each factor's impact scores in each township according to appropriate criteria, finally, the comprehensive impact score can be worked out following Eq.(1).

$$F_z = \sum_{i=1}^{n} P_i F_i \tag{1}$$

Where F_z is comprehensive impact score; P_i is the weight of factor i; F_i is the impact score of factor i.

After the comprehensive impact scores for each township are calculated, equal division method can be used to divide grade according to the scores' distribution feature, and then, compared with the result of area superposition, rural settlement partition result can be worked out.

4. Results

4.1. Partition of rural settlement in Cishan

According to mining areas' land use characteristics and status of rural settlements, four factors which can affect the rural settlement partition's direction are selected. They are distribution of mineral resources, urban development case, farmland protection positioning and ecological protection positioning.

The factors' treatment consists of two parts. First, we take village as administrative unit and use Mapgis to overlay each factor map to form initial partition result. Second, qualitative analysis and Eq. (1) can be used to calculate the comprehensive impact scores (Table 1).

Table 1. The factor's impact score for each township

	UDC(0.17)	FPP(0.23)	DMR(0.33)	EPP(0.29)	CIS
shangluoyang	2	3	4	3	3.22
xialuoyang	2	3	3	3	2.89
xiwannian	2	3	4	3	3.22
xikongbi	2	3	4	2	2.93
liuzhuang	2	2	3	3	2.66
cuilu	3	3	3	3	3.06
dongkongbi	2	3	4	2	2.93
liutianjing	1	2	3	2	2.20
chaitianjing	2	2	2	3	2.33
gaotianjing	1	2	2	3	2.16
shentianjing	2	2	2	3	2.33
koutianjing	2	2	2	3	2.33
lvtianjing	1	2	2	3	2.16
mingyu	1	2	2	3	2.16
nangang	2	2	2	2	2.04
zhongkongbi	1	1	3	2	1.97
huafucun	1	2	2	2	1.87
yanshan	1	1	2	3	1.93
xiyuancheng	1	2	2	2	1.87
niantou	1	2	2	2	1.87
niuwapu	1	2	2	2	1.87
cishanyijie	2	1	1	1	1.19
cishanerjie	2	1	1	1	1.19

Note: DMR, distribution of mineral resources; UDC, urban development case; FPP, farmland protection positioning; EPP, ecological protection positioning; CIS, comprehensive impact score

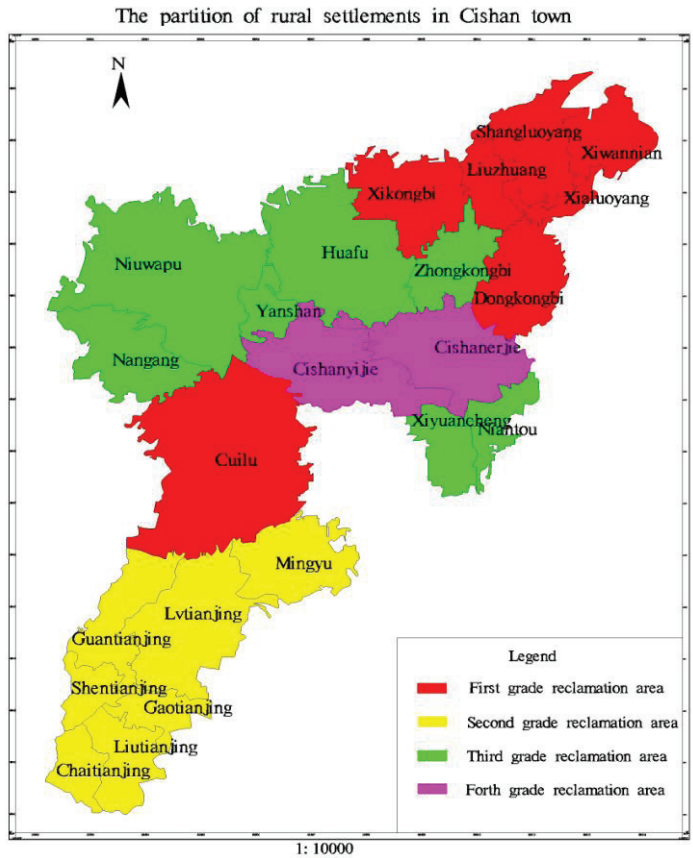

Fig.2. The partition of rural settlements in Cishan town

From the evaluation results, the characteristics of rural settlement in Cishan town are obviously different for different areas. According to the comprehensive impact score in table 1, equal score can be defined as 0.5 with the application of equal division method.

The initial zoning map is formed by space overlay for each factor. And then, according to each township's comprehensive impact score, present land use and the positioning of planning land use, a reasonable analysis is taken. After an appropriate adjustment, the final partition of rural settlements is worked out (Fig.2). Combining the economic development level, the actual conditions of rural settlements, and the reclamation conditions of local settlements in Cishan town, four grades of partition are made. The grade is divided into four levels, as first, second, third and forth. And then, differential reclamation measures are established for different partition grade to make sure that the rural settlement can provide a good environment for ecological and social security in mining areas.

4.2. Differential reclamation measures

After partition of rural settlements in Cishan town, in order to achieve the most optimal and efficient reclamation, the need for the development of rural settlements in different regions of differential reclamation measures comes out. These can improve the regional ecological environment effectively, and improve living conditions for mine people. At last, a security environment for mine production which includes land resources safety, ecological security and social security can be established.

The first reclamation area is mining accumulation area. The reclamation measures should take a comprehensive consideration on ecological and living environment. In accordance with the standards of the town, the strategy which includes overall relocation or relocation by stages is useful. Local government can adopt the principle of proximity, merged it into the center village or administrative villages, and then reclaim the small village for cultivated land. The center villages should be planed properly includes housing construction, road construction, hydropower engineering design and the supporting infrastructure construction. The dominant form can let the government be the leader, the collective village be the assister and the villagers be the coupler. This will build a new socialist countryside, improve

quality life of the villagers, replace irrational rural residential land, replenish cultivated land and meet the needs of urban construction land.

The second reclamation area should be from the replenishing cultivated land, replacing construction land index point of view, with the view of improving the efficiency of land resources use and making a reasonable adjustment of land use structure, meanwhile, take a comprehensive consideration on the development planning and economic strength in Cishan town in next few years, adopt the situ rehabilitate model to renovate rural settlements. At macro-level, the second reclamation area divides into two geographical areas, but at the micro-level, the rural settlements are kept contiguous phenomenon. Therefore, from the cost point of view, taking the form of "connect district to form polymerization area" model to renovate each small district is valuable. The model can be considered the global nature of the target area, to solve the limitations of processing a single object, while the cost can be controlled.

The third reclamation area's reclamation model is controlling the development. For the rural settlements in this region, to strictly control the arbitrary expansion, not occupy agricultural land and construction land optionally. Some measures can be taken based on the original foundation. Such as infrastructure construction, road repair, hydroelectric power improvement and so on. These should try to avoid the project which involves large changes in land use structure, like demolition and relocation. The implementation of these measures can not only coordinate the harmonious development of socio-economic in Cishan town, but also to balance the land use, protect farmland, limit the extreme expansion of construction land.

The forth reclamation area includes two administrative villages, namely, Cishanyijie and Cishanerjie. They are the original town, rural settlements are few, mainly around the industrial area. Either from the layout of the form or facilities environment is relatively good. So it isn't the reclamation point in this study.

5. Conclusion

Cishan town, in Wu'an city, is a mining area. The rapid development of mining industry has a great impact on the local ecological environment and living environment of residents. In this paper, relying on the context of new rural development, the partition and reclamation model for rural settlements in mining areas is established. Though research that the rural settlements in Cishan town can be divided into four grade area, and from the standpoint of aesthetic, economic, and ecological, differential reclamation measures are put forward. The research results can effectively promote the ecological environment construction in Cishan town, improve people's lives around the mine environment and optimize the allocation of land resources in mining area. Finally, it can provide good ecological, social and land resources environment for mine safety production.

Acknowledgements

This article is supported by "the Fundamental Research Funds for the Central Universities". Authors gratefully thank the government of Wu'an for offering the basic data and related information.

References

[1] David Laurence. 2011. Establishing a sustainable mining operation: an overview. Journal of Cleaner Production. 19,278-284.

[2] Laurence, D.C., 2005. Safety rules and regulations on mine sites e the problem and a solution. Journal of Safety Research. ISSN: 00224375 36 (1). ISSN: 00224375,39e50.

[3] WuCL. 2008. Strengthen safety management for mine safety production. Xinjiang Nonferrous Metals. 2,102-104(in Chinese).

[4] LiZX. LiCP. ZhaoYQ.YuanF.2010. The theory, problems and solutions for mine safety, sustainable and social responsibility organizations. Forum on China's sustainable development. Shandong(in Chinese).

[5] Hualou Long, Yansui Liu, Xiubin Li, Yufu Chen. 2010. Building new countryside in China: A geographical perspective.Land use policy. 27,457-470.

[6] Ding, C.R., 2007. Policy and praxis of land acquisition in China. Land Use Policy 24,1 – 13.

[7] Clout, H., 2006. Rural France in the new millennium: change and challenge. Geography 91, 205 – 217.

[8] Hoalou Long, Yansui liu, Xiuqin Wu, Guihua Dong(2009) Spatio-temporal dynamic patterns of farmland and rural settlements in Su-Xi-Chang region: Implications for building a new countryside in coastal China. Land use policy.26,322-333.

[9] Long, H.L., Heilig, G.K., Li, X.B., Zhang, M., 2007b. Socio-economic development and land-use change: analysis of rural housing land transition in the Transect of the Yangtse River, China. Land Use Policy 24 (1), 141 – 153.

[10] Zhang JJ, Fu MC, Tao J, Huang Y, Hassani FP, Bai ZK (2010) Response of ecological storage and conservation to land use Transformation: a case study of a mining town in China. Ecological Modelling 221,1427–1439 .